

Carrier and Surface Ship E-prog Template

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| Weapon System and Application | C5I (Command, Control, Communications, Computer, Combat and Information) Systems |
| E-Prog Need Details | <ul style="list-style-type: none"> •Prediction horizon could be in hours or days depending on the mission and will vary with mission •Confidence levels need to be established |
| Development Program Elements | <ul style="list-style-type: none"> •Must support Fleet needs metrics <ul style="list-style-type: none"> – right timed maintenance (if we can predict when it will fail, we can replace it at the most opportune time) – decreased requirement for onboard sparing – decreased time requirements for troubleshooting (less stress on maintenance infrastructure) •Must promote a remote monitoring sustainment philosophy freeing sailors to focus on operations and the shore community on maintenance and logistics |
| Current S&T and RDT&E Applicability | <ul style="list-style-type: none"> •None know to Fleet •Fleet needs to be informed about BIT diagnostic and prognostics capabilities inherent in commercial systems to drive requirements to the Program Offices |
| S&T and RDT&E Needs and Development Program Timelines | <ul style="list-style-type: none"> •LCS (IOC 2007, V&V 1year) •DDX (IOC 2012, V&V 5 years) •Legacy ships <ul style="list-style-type: none"> –Implement BIT capabilities inherent in commercial components –spiral development and insertion starting in FY07 based on component criticality based on the mission dependency algorithms deployed in support of DRRS |

Ships' Surface Ship E-prog Template

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| Weapon System and Application | DDX – Integrated Power Systems (IPS) |
| E-Prog Need Details | <ul style="list-style-type: none"> •High power switching electronics prognostics <ul style="list-style-type: none"> –What are the failure mechanisms and how can you sense them? •What are the critical systems and what are requirements are needed for advanced diagnostics and prognostics |
| Development Program Elements | <ul style="list-style-type: none"> •Must work with power semi conductor manufacturers •Must work with universities on advanced algorithms •Must be able to acquire and analyze data •Must work with fleet to analyzed faults •Must report through MRSS and incorporate ICAS |
| Current S&T and RDT&E Applicability | <ul style="list-style-type: none"> •Advanced sensor research including fiber optic current, voltage, temperature, and stress/strain. •Partial discharge sensors to monitor for insulation breakdown •Semiconductor manufacturers are researching failure and prognosis on device level |
| S&T and RDT&E Needs and Development Program Timelines | <ul style="list-style-type: none"> •How can competitors be encouraged to work together and share information •A system perspective must be maintained •Must be able to test hardware and software on ship equivalent systems •DDX (IOC 2012, V&V 5 years) |

Surface Ship E-prog Template

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| Weapon System and Application | Unmanned Surface Vehicles (USVs) |
| E-Prog Need Details | <ul style="list-style-type: none"> •Electronic Prognostics needed for 20 hr missions •Insertion of Intelligent Autonomy for Integrated Ship Health Management (ISHM) to process sensor input in the context of the Vehicle Health State (fuel, power, mission-driven path planning, environmental history, subsystem s/w and h/w and component pedigree/burnin) |
| Development Program Elements | <ul style="list-style-type: none"> •Map subsystem criticality and failure modes •Map existing subsystem BIT that could be accessed and stored externally to develop a data base for prognostic driven logistics •Map s/w leakage and trac s/w undefined state to logistic statistics |
| Current S&T and RDT&E Applicability | <ul style="list-style-type: none"> •Development of both behavior based and fuzzy logic autonomy for hazard avoidance |
| S&T and RDT&E Needs and Development Program Timelines | <ul style="list-style-type: none"> •Embedded BIT for training and health monitoring of subsystems |

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| Weapon System and Application | <ul style="list-style-type: none"> •HME Control and Monitoring Networks and Cargo and Weapons Handling Systems <ul style="list-style-type: none"> –Secondary/backup power supplies –Network switches –Server Blades |
| E-Prog Need Details | <ul style="list-style-type: none"> •Prognostic needs for ships have not been evaluated |
| Development Program Elements | <ul style="list-style-type: none"> •Base development on inherent capabilities of commercial components •Determine how to implement prognostic capabilities that are available for same components in industry |
| Current S&T and RDT&E Applicability | <ul style="list-style-type: none"> •Adapt Sun Microsystems technology |
| S&T and RDT&E Needs and Development Program Timelines | <ul style="list-style-type: none"> •No work in this area yet but lower manning and ship skill sets require immediate attention |

Prognostics Must Provide Fleet Dividends

- Must offset loss of shipboard logistics and maintenance capabilities resulting from
 - reduced manning ships (less technician hours for preventive and corrective maintenance)
 - reduced OPTAR (less ability to stock and use spare parts)
 - higher OPTEMPO (less available "down hours" for systems)
 - more operators, less maintainers (pipeline training not as robust as it used to be with regards to electronic troubleshooting)
 - reduced shore infrastructure and maintenance budgets (less travel, fewer techs)

Issues To be Addressed

- Mission criticality of redundant Systems, equipment, and components
- Establishment of equipment and component failure and usage data reservoirs and establishment of protocols and agreement to enable multiple vendor access
- Policy, procedures and standards to encourage and facilitate development of APIs to access existing commercial electronic component BIT data
- Stand-up of Fleet and Acquisition Program POCs/Champions for electronics prognostics
- A new contract philosophy is needed to encourage cross vendor sharing of intellectual property (no freebees...agreements and compensation guidelines)
- Ship acquisition offices design to readiness and availability requirements and, therefore, cannot justify incorporation of prognostics even though it may be written into the requirements documents